"The Spectrum of η Argus." By Sir DAVID GILL, K.C.B., LLD., F.R.S., H.M. Astronomer at the Cape. Received May 24,—Read June 6, 1901.

[PLATE 4.]

The star η Argus, as is well known, was for a short time almost the brightest star in the heavens. Between 1677 and 1870 its light fluctuated between magnitude 0 and 6·8, and, since the latter date has gradually faded from $6\frac{3}{4}$ to $7\frac{3}{4}$—its magnitude at the present day.

Soon after the McClean telescope was mounted, and by way of testing its performance, a plate was taken, with the object-glass prism of $8\frac{1}{4}^{\circ}$ refracting angle in front of the object glass, of the area of the sky surrounding η Argus.

As this plate showed that η Argus had a very remarkable bright-line spectrum, an attempt was made to obtain a spectrograph with the slit spectroscope, together with a comparison spectrum. Within the past few weeks I have been engaged in measuring some of these experimental spectrograms—a work that other occupations had until now prevented me from undertaking.

As the reductions of the measures show that the spectrum of η Argus closely resembles that of the Nova Aurigæ, it seems to be of considerable interest, in view of the appearance of Anderson's new star in Perseus, to publish the present results, although in many respects they are not so complete as might otherwise be desirable. Thus I have no doubt that, by sacrificing the definition near Hγ and by a longer focal setting and longer exposure, one could get a considerable extension of the spectrum in both directions with the objective prism, and, with the slit-spectroscope, obtain a good determination of the velocity of the star in the line of sight by a much shorter exposure and with direct comparison of the brightest star-line with Hβ. These further points may, however, remain for future investigation.

The plate taken with the slit spectroscope is shown in fig. 1 (Plate 4). It was exposed as follows :—

1899.	April 14	Exposure	165 minutes.
	,, 15	,,	10 ,,
	,, 16	,,	150 ,,
	,, 17	,,	45 ,,
	Total.....		6 h. 10 m.

The comparison spectrum of iron was obtained from a single brilliant spark between iron terminals connected with a powerful coil and battery of Leyden jars immediately before the first day's exposure.

Eleven selected iron lines were carefully measured with the Toepfer micrometer. A least-square solution with Hartmann's formula gave

$$\lambda = 2180{\cdot}30 - \frac{181854{\cdot}2}{n - 128{\cdot}8971}$$

(λ_0) (C) (n_0)

of which the residuals respectively were

λ.	Resid.	λ.	Resid.
4063·72.....	−0·03	4404·79.....	−0·15
4171·82.....	−0·02	4476·34.....	0·15
4118·90.....	0·18	4529·1	0·30
4143·85.....	−0·16	4872·25.....	0·35
4260·61.....	−0·06	4957·50.....	−0·18
4325·88.....	−0·10		

In determining the wave-lengths of the lines in the spectrum of η Argus the above formula was not used, as the representation did not seem sufficiently exact nor could the whole spectrum be conveniently measured at once.

The attached table shows the subdivisions of observation and computation. The above value of λ_0 was retained in the computations, but n_0 and C were determined separately for each block. The means of the micrometer readings are corrected for the carefully determined errors of the screw.

It will be noted that we get for the wave-lengths of the hydrogen lines the following results:—

	Observed.	Known.	K − O.
H_β	4863·38	4861·49	−1·89
H_γ	4343·71	4340·66	−3·05
H	4105·08	4101·85	−3·23

As there is no symmetry between the time of exposure of the plate to the iron flash and to the star-spectrum, we cannot suppose this displacement to be necessarily due to motion of the star; it is more probably due to change of temperature, &c., in the spectroscope. The wave-lengths given in the separate column are corrected for displacement so as to bring out the wave-lengths of the hydrogen and other lines at their true values.

The wave-lengths of the corresponding bright lines in the spectrum of Nova Aurigæ as observed at the Lick Observatory or Potsdam,* are given in the adjoining column, and the agreement is very remarkable.

The photograph with the object-glass prism was taken in 1899, January 14, with an exposure of one hour. The star was trailed to and fro for 0·5 mm., the guiding being done by a neighbouring star viewed in the guiding telescope. The original negative is enlarged 5 diameters in the plate sent (fig. 2, Plate 4).

* Scheiner's (Frost) 'Astronomical Spectroscopy,' p. 287.

The wave-lengths given in the object-glass prism table were derived from careful measures which were converted into wave-lengths by Hartmann's formula and the known wave-length of the hydrogen lines.

The wave-lengths resulting from the object-glass prism are naturally far less reliable than those from the slit spectroscope.

From the very exact agreement between the spectrum of η Argus and that of the Nova Aurigæ, it appears that whatever the causes of the origin of the Nova in Auriga, very similar causes have probably produced the historical changes in the brightness of η Argus.

Table.

Spectrum of η Argus. Measures from slit spectrograph.						Corresponding bright lines in spectrum of Nova Aurigæ.	η Argus (objective prism).	
Comparison. Micrometer. R.	Spectrum. Fe.	Spectrum of η Argus.			λ Corected for displacement.	P = Potsdam. L = Lick. λ	λ	Int.
		Micrometer.	λ	Int.				
63·4193	4957·68	...	...	...	...	...	5018·2	2
		62·6624	4925·9	6	4924·2	P 4923	4924·5	4
		61·1187	4863·38 Hβ	40	4861·49	P 4862 Hβ	4861·49	40
		59·8889	4815·6	2	4813·5	...	4811·6	1
54·6904	4630·90	57·5872	4730·5	2	4828·2	...	4727·0	3 br.
54·6896	4630·90	...	...	...	...	...	4665·8	3 v. br.
54·4117	4622·00	54·6871	4630·9	4	4628·5	P 4628	4627·6	8
		54·4070	4621·7	2	4619·3	...	—	—
		53·2965	4585·9	7	4583·4	P 4583	4583·4	7
		52·8596	4572·1	3	4569·6	L 4570	—	—
		52·4900	4560·5	6	4558·0	P 4557	—	—
		52·2008	4551·5	7	4549·0	L 4549	4552·2	—
		51·6428	4534·4	4	4531·8	P 4530	—	—
		51·2971	4523·9	5	4521·3	P 4520	4518·8	v. v. b.
		51·0199	4515·6	2	4513·0	—	—	—
		50·7851	4508·6	2	4506·0	—	—	—
		50·5527	4501·7	1	4499·1	—	—	—
		50·2154	4491·7	4	4489·1	L 4490	4487·7	5 v. br.
		49·6058	4474·0	1	4471·3	$\frac{L+P}{2}$ 4472	4472·4	—
		49·4519	4469·5	1	4466·8	—	—	—
		49·1225	4460·1	2	4457·4	—	—	—
		48·9977	4456·5	2	4453·9	—	—	—
		48·7287	4448·9	2	4446·2	P 4445	—	—
		48·5516	4444·0	2	4441·3	—	4441·6	—
47·5260	4415·33	47·5599	4416·3	10	4413·6	P 4417 ?	4414·0	—
47·1436	4404·94	...	...	...	...	...	...	10
47·1424	4404·94	...	...	...	...	...	4395·8	3
46·3547	4383·72	45·4700	4360·7	9	4357·5	...	4360·3	1
44·1345	4325·98	45·1883	4353·3	6	4350·2	L 4355	4354·5	20
43·4232	4308·02	44·8215	4343·71 Hγ	10	4340·66	L 4340 Hγ	4340·66	20
43·1062	4299·44	...	...	...	...	...	4300·9	4
42·9005	4294·32	42·6890	4289·1	9	4286·1	...	4286·0	10
42·4178	4282·54	42·2246	4277·7	3	4274·7	...	4275·3	3
41·9777	4271·68	—	—	—	—	—	—	—
41·5002	4260·67	—	—	—	—	—	—	—
41·0769	4250·65	40·8929	4245·8	7	4242·7	...	4242·4	7
40·0791	4227·65	40·4445	4235·3	5	4232·2	...	4232·2	7
39·7487	4219·52	—	—	—	—	—	—	—
36·3117	4144·01	...	...	...	...	P 4176	4174·8	6 br.
35·1127	4118·72	...	...	...	...	L 4166 P 4158	4164·4	—
32·7827	4071·84	34·5930	4108·2	Suspected	4105·0	—	—	—
32·3631	4063·75	34·4388	4105·08 Hδ	3	4101·85	L & P Hδ	4101·85	8
—	—	—	—	—	—	—	4067·0	1

br = broad ; v. br. = very broad.

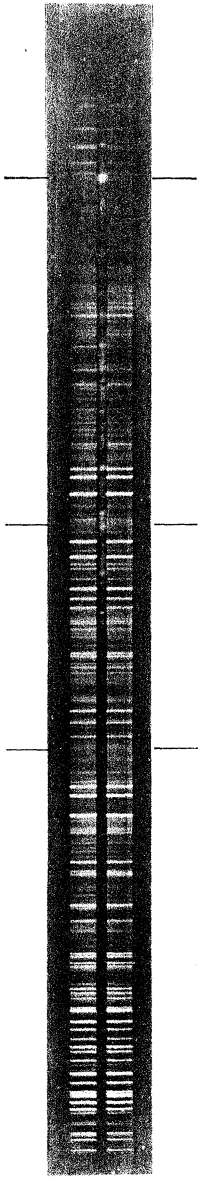

Fig. 1.

Fig. 2.

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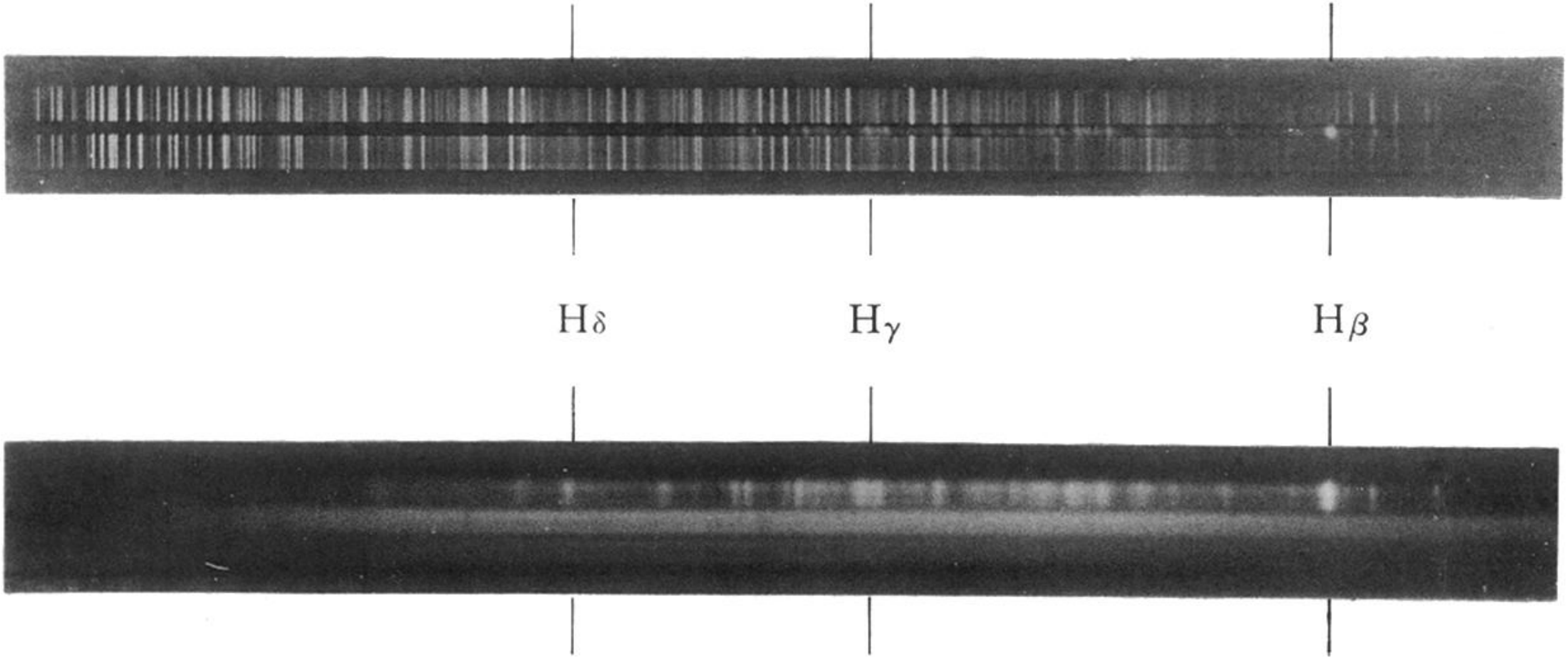

Fig. 2.